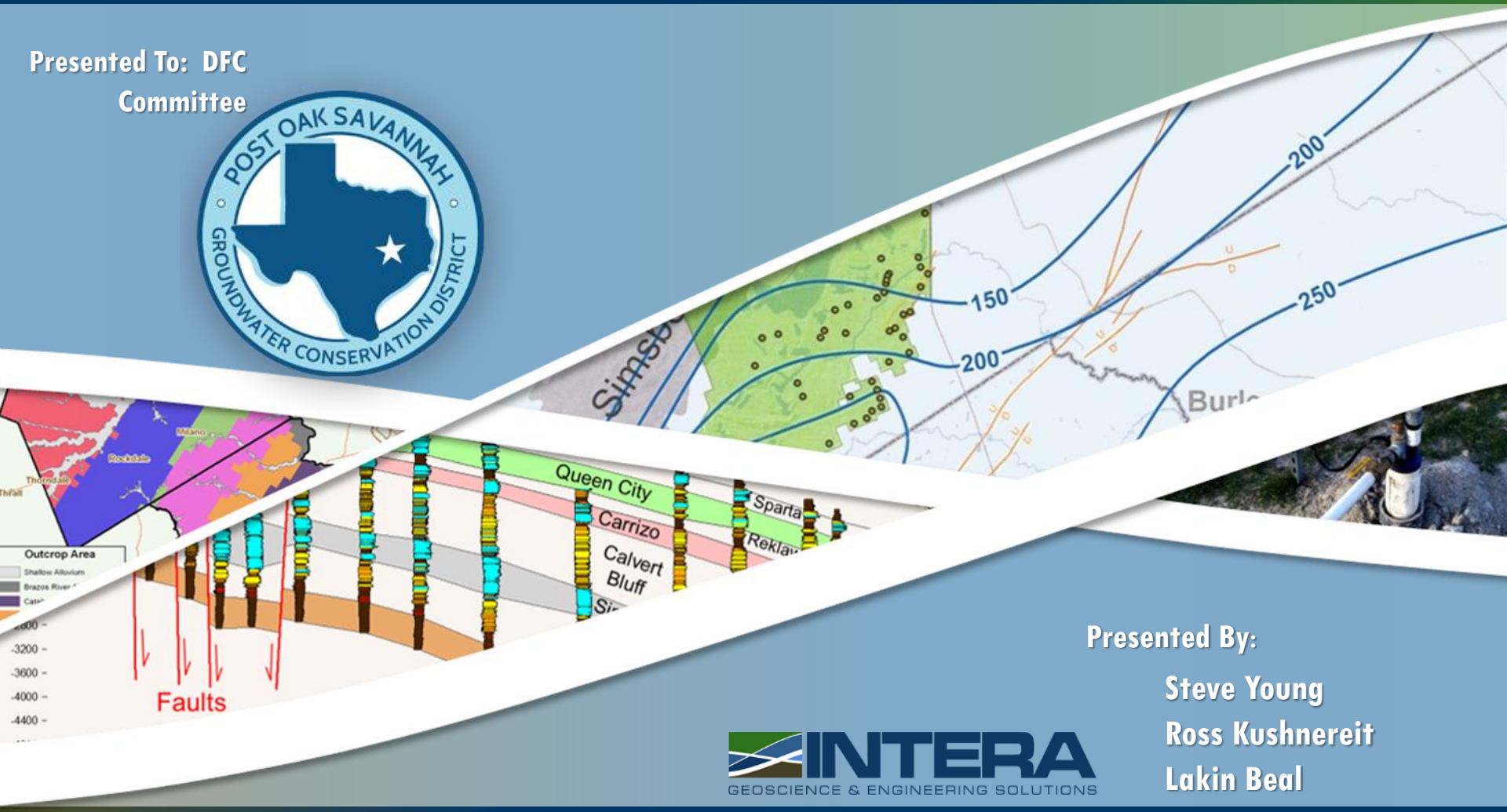
Desired Future Conditions Committee Update:

Presented To: DFC Committee



Presented By:

Steve Young
Ross Kushnereit
Lakin Beal

INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS

November 15, 2022

Agenda

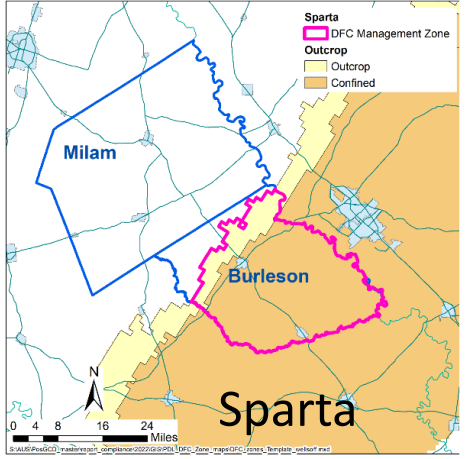
- Final Compliance Report
- Preliminary Results form the GANA Report
- Drilling Guidance
- Operational Model Update

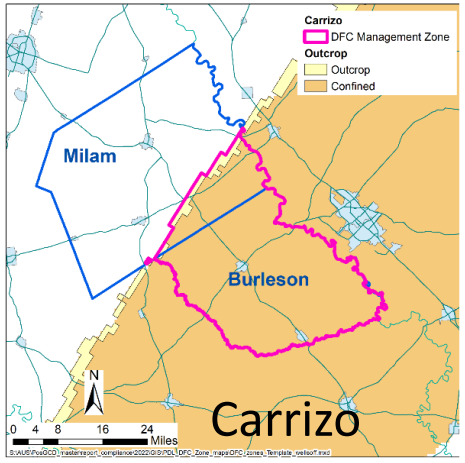
2022 DFC and PDF Compliance
&
2011 to 2022 Drawdown Maps

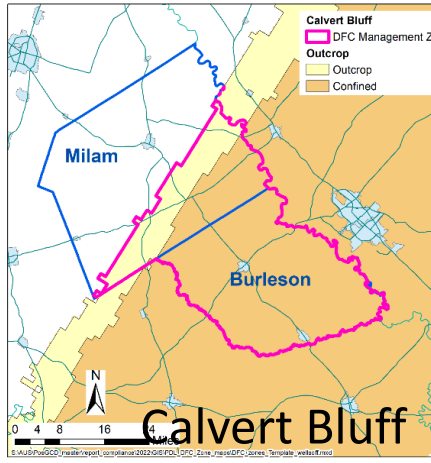
DFC Management Zones

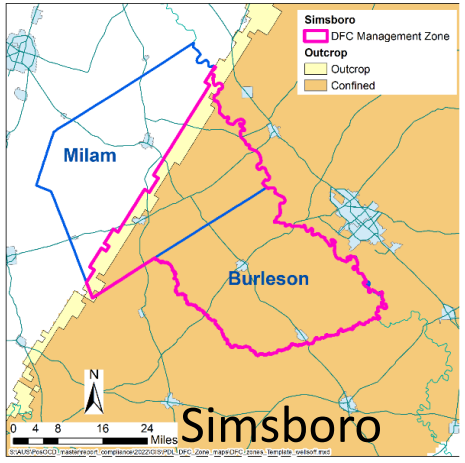
- Spans the aquifer footprint within the District
- Yegua-Jackson and Brazos Valley Alluvium not shown

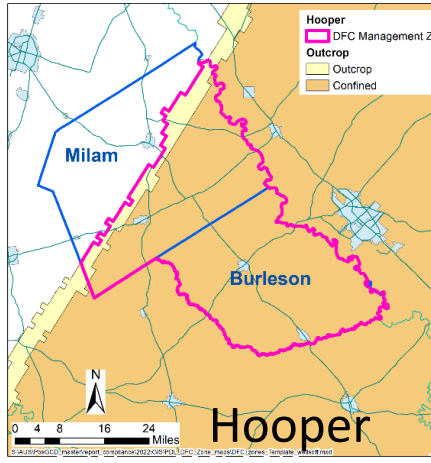
Aquifer	2070 Drawdown
Sparta	32
Queen City	30
Carrizo	146
Upper Wilcox (Calvert Bluff Fm)	156
Middle Wilcox (Simsboro Fm)	278
Lower Wilcox (Hooper Fm)	178







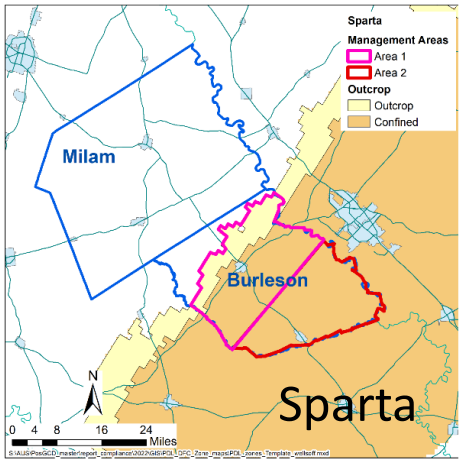


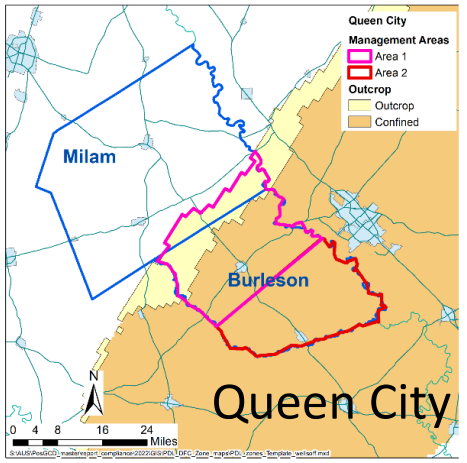


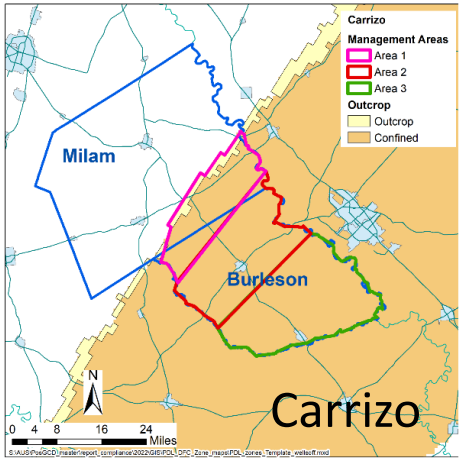
PDL Management Areas

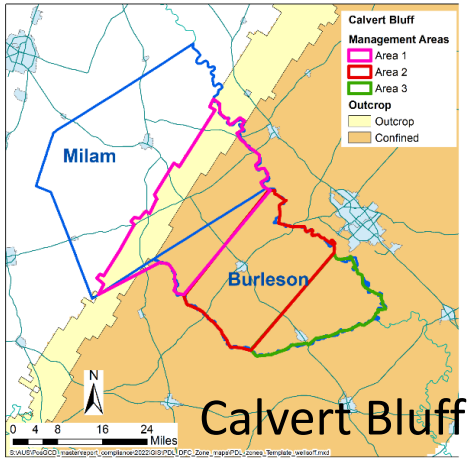
- Management Zones has been partitioned into Management Areas
- Only Management Areas with sufficient monitoring wells are have PDLs

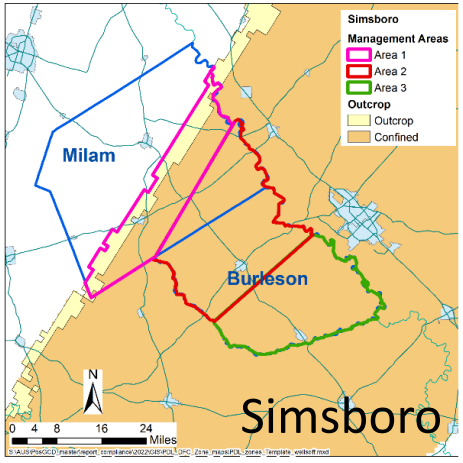
Management Area		2070 Drawdown
Sparta	Area 1	28
Queen City	Area 1	75
Carrizo	Area 1	75
	Area 2	175
Calvert Bluff (Upper Wilcox)	Area 1	88
	Area 2	223
Simsboro (Middle Wilcox)	Area 1	91
	Area 2	335
Hooper (Lower Wilcox)	Area 1	210

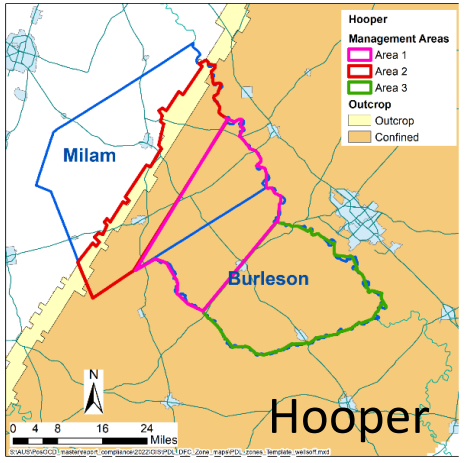












DFCs and PDLs

Desired Future Conditions

Aquifer	2070 Drawdown
Sparta	32
Queen City	30
Carrizo	146
Upper Wilcox (Calvert Bluff Fm)	156
Middle Wilcox (Simsboro Fm)	278
Lower Wilcox (Hooper Fm)	178

Protective Drawdown Limits

Management Area		2070 Drawdown
Sparta	Area 1	28
Queen City	Area 1	75
Carrizo	Area 1	75
	Area 2	175
Calvert Bluff (Upper Wilcox)	Area 1	88
	Area 2	223
Simsboro (Middle Wilcox)	Area 1	91
	Area 2	335
Hooper (Lower Wilcox)	Area 1	210

DFC Compliance 2022 Evaluation

Management Zone	2070 DFC (ft)	Avg. Drawdown (ft) / % of DFC	Compliant with DFC
Sparta	32	12.0 (37.6%)	Yes
Queen City	30	13.1 (43.5%)	Yes
Carrizo	146	51.6 (35.4%)	Yes
Calvert Bluff (Upper Wilcox)	156	40.8 (26.2%)	Yes
Simsboro (Middle Wilcox)	278	38.9 (14%)	Yes
Hooper (Lower Wilcox)	178	11.6 (6.5%)	Yes
Yegua-Jackson	61	-16.3 (-26.7%)	Yes

PDL Compliance 2022 Evaluation

Management Area		2070 PDL (ft)	Avg. Drawdown (ft) / % of PDL	Compliant with PDL
Sparta	Area 1	28	2.9 (10.2%)	Yes
Queen City	Area 1	75	0.1 (0%)	Yes
Carrizo	Area 1	75	9.7 (13%)	Yes
	Area 2	175	74.5 (43%)	Yes
Calvert Bluff (Upper Wilcox)	Area 1	88	11.9 (14%)	Yes
	Area 2	223	69.7 (31%)	Yes
Simsboro (Middle Wilcox)	Area 1	91	-6 (-7%)	Yes
	Area 2	335	64.2 (19%)	Yes
Hooper (Lower Wilcox)	Area 1	210	11.9 (6%)	Yes

Threshold 1 = 50% PDL **Threshold 2 = 60% PDL** **Threshold 3 = 75% DFC**

Analysis of Measured Water Levels

- Water Levels
  - >70% of the wells screen is in a single aquifer
  - Measure water levels January 1 to April 30
  - 3-year average for water levels

- Interpolation Methods
  - Creates a continuous set of values across entire aquifer
  - Use Three Methods
    - Topo to Raster
    - Kriging with Water Levels
    - Kriging with Measured Water Levels and Simulated Water Levels

Post Oak Savannah Guidance Document for Evaluating Compliance with Desired Future Conditions and Protective Drawdown Limits

Prepared for:

Post Oak Savannah Groundwater Conservation District
310 E Ave C
Milano, TX 76556

Prepared by:

INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS

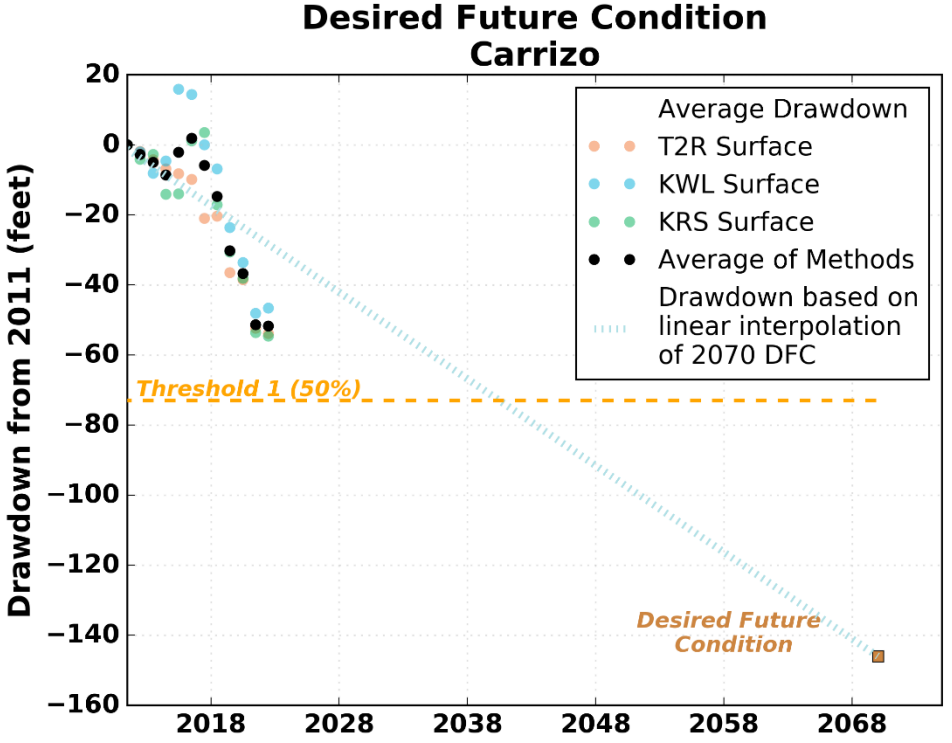
9600 Great Hills Trail
Suite 300W
Austin, TX 78759

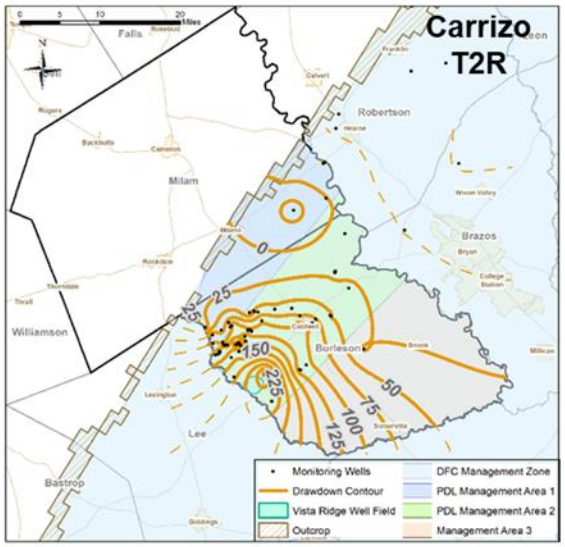
December 2021

Version 2.0

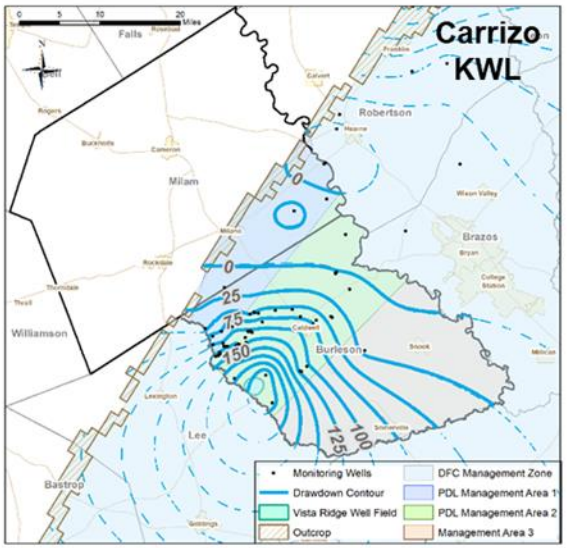
Drawdown 2011 – 2022: Carrizo

- T2R – Commonly used for mapping land surfaces
- KWL – Kriging using water levels
- KRS – Kriging using water levels and model results

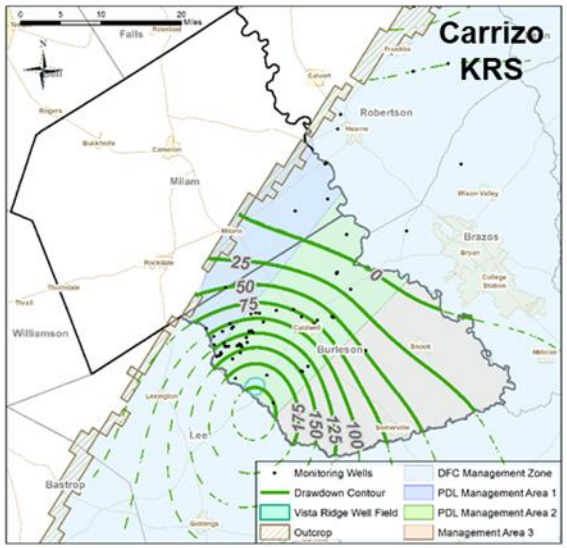




Monitoring Wells used in Carrizo: from 2011 to 2022
T2R Interpolation



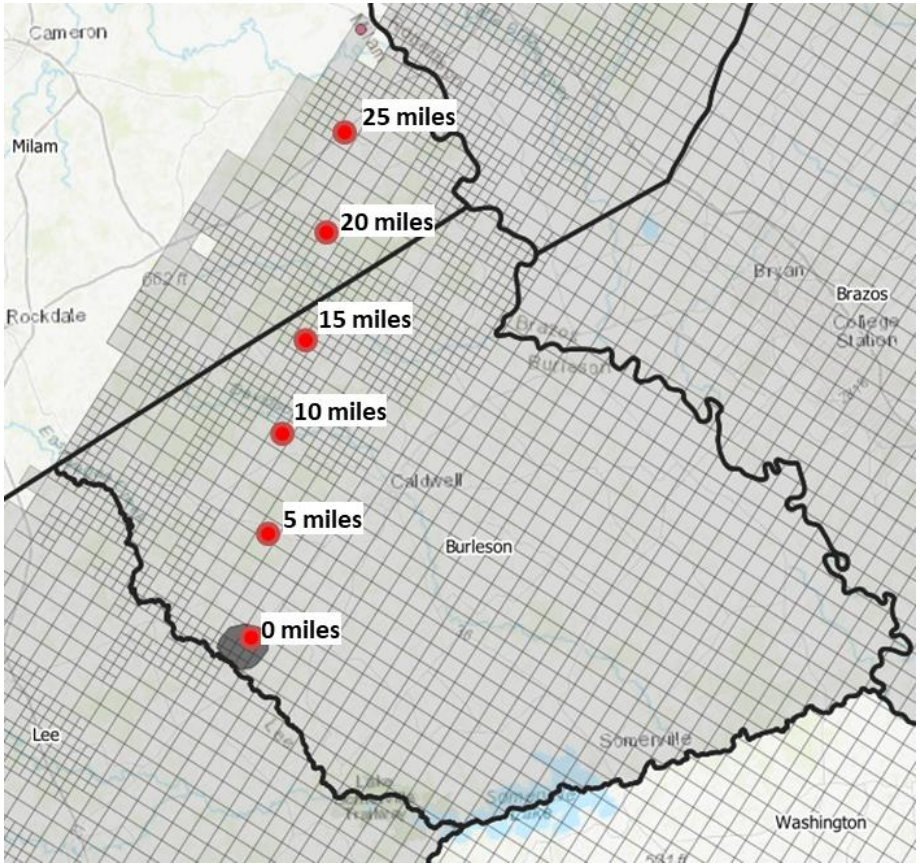
Monitoring Wells used in Carrizo: from 2011 to 2022
KWL Interpolation



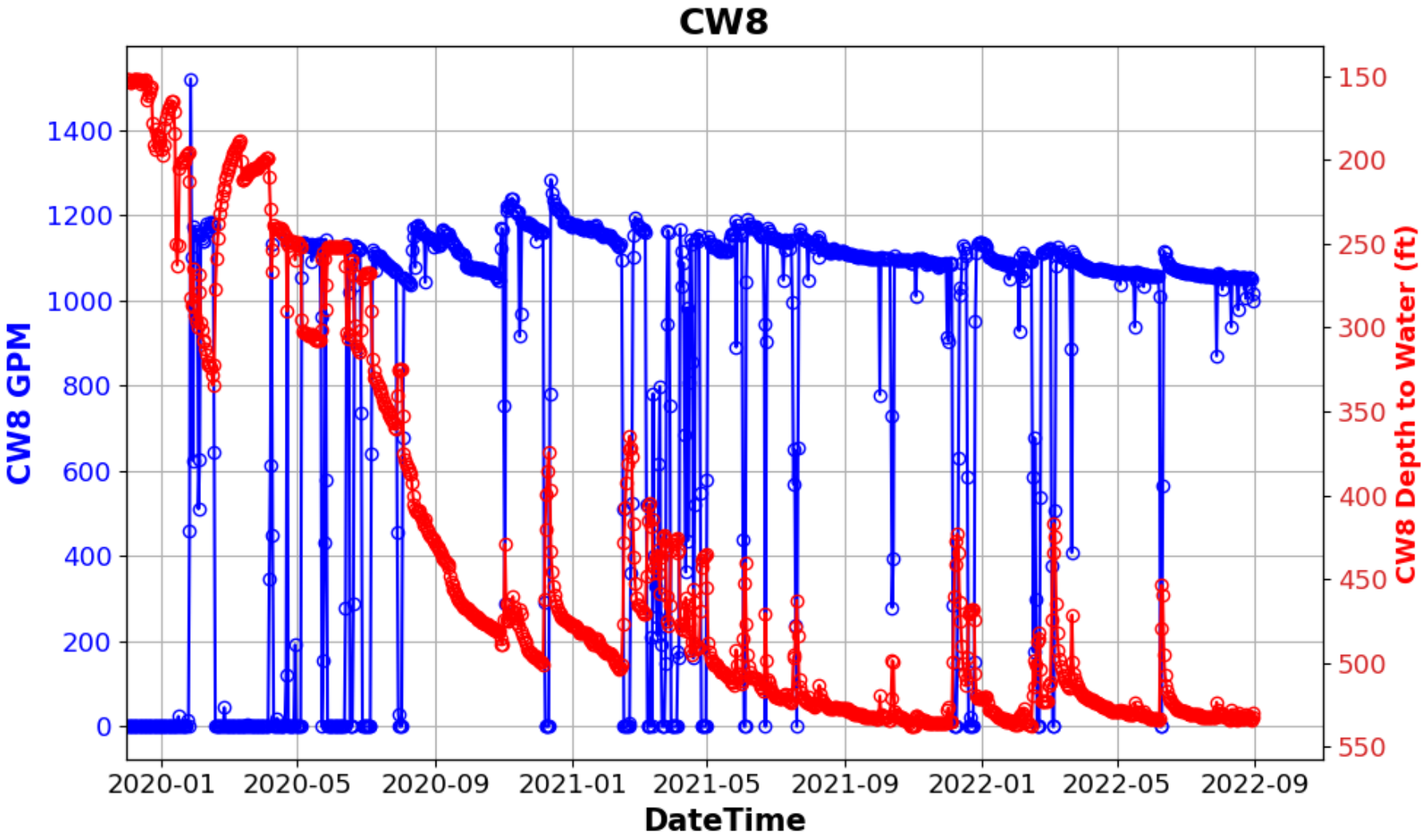
Monitoring Wells used in Carrizo: from 2011 to 2022
KRS Interpolation

Simulated Responses in Carrizo Aquifer: Locations

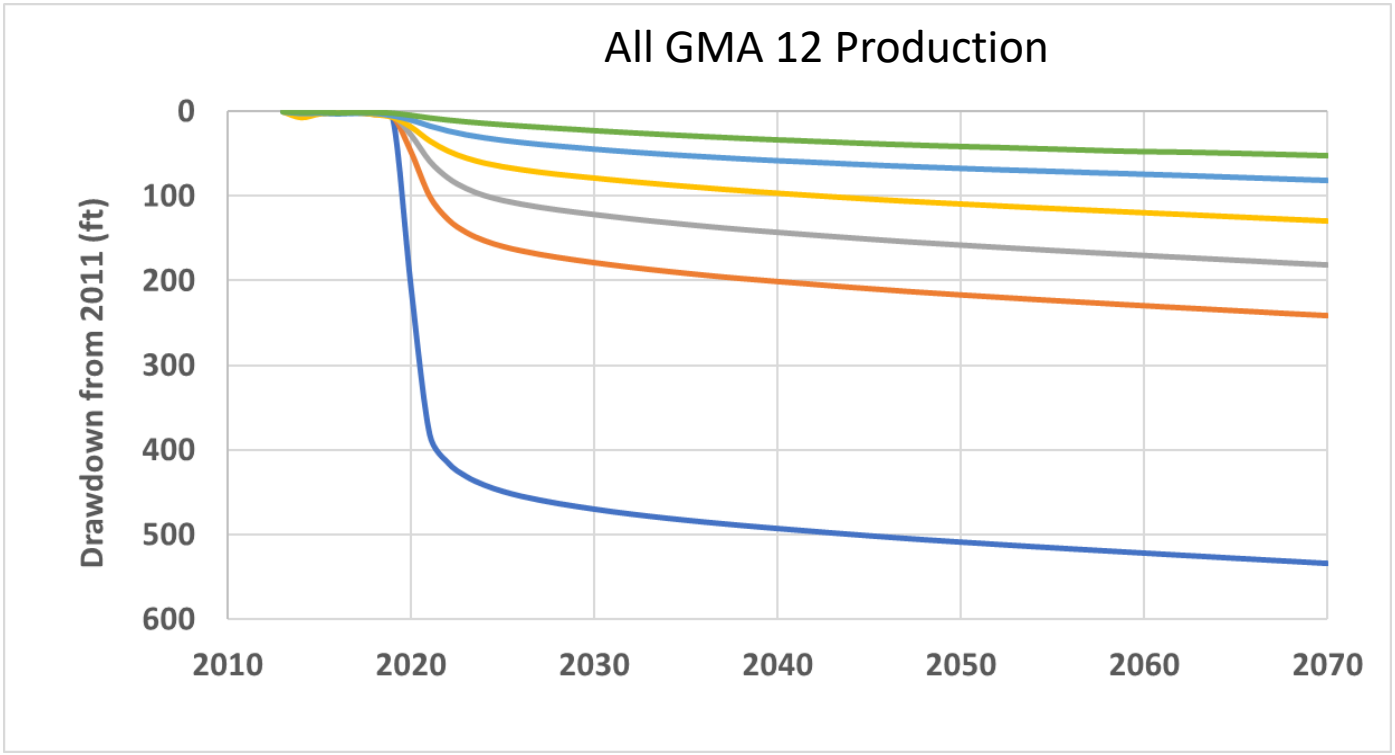
- Use pumping from a GMA 12 model simulation
- Estimate drawdown at six locations shown in figure



Aquifer Response at the Vista Ridge Well Field



Simulated Drawdowns in Carrizo Aquifer: Time-Drawdown

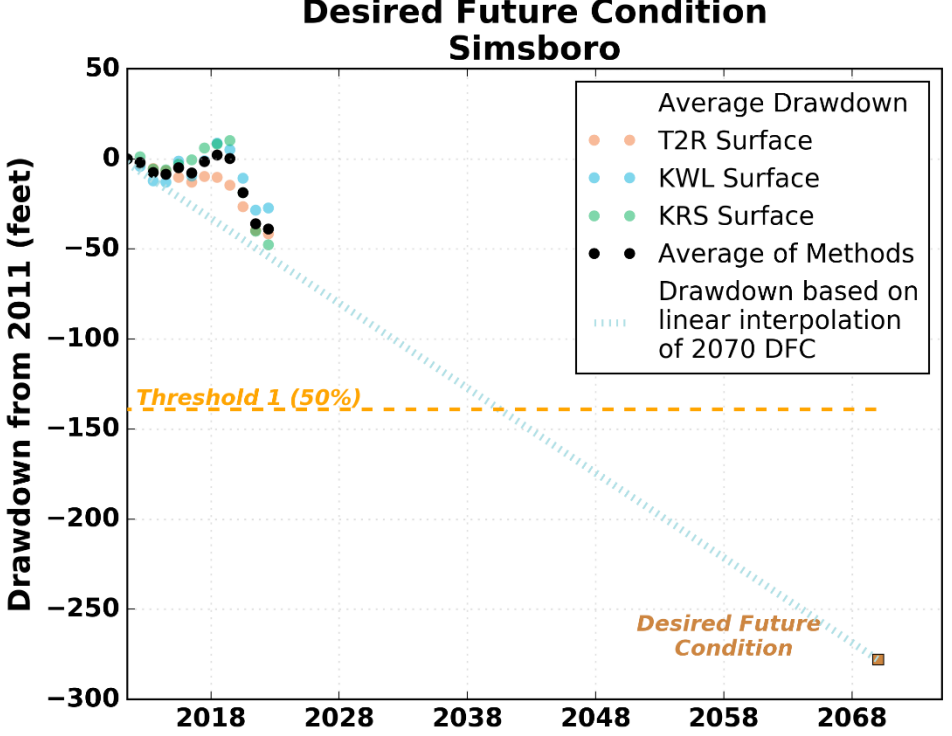


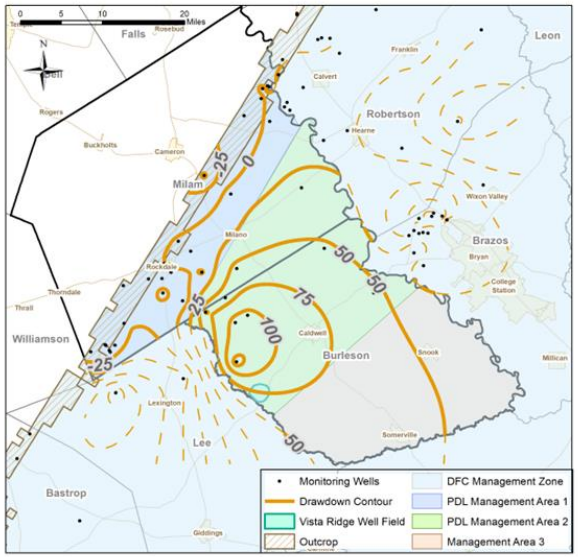
Distance (miles)	Estimated Time (yrs) to Reach a Percentage of 2070 Drawdown		
	50%	70%	90%
0	<2	2	13
5	3	8	31
10	4	13	35
15	6	17	38
20	9	20	40
25	14	24	40

Distance (miles)	Max 2011-2071 Drawdown		
	All GMA 12 Production	Only Vista Ridge	% VR
0	534	446	83%
5	241	156	65%
10	181	98	54%
15	130	55	42%
20	82	22	27%
25	53	9	18%

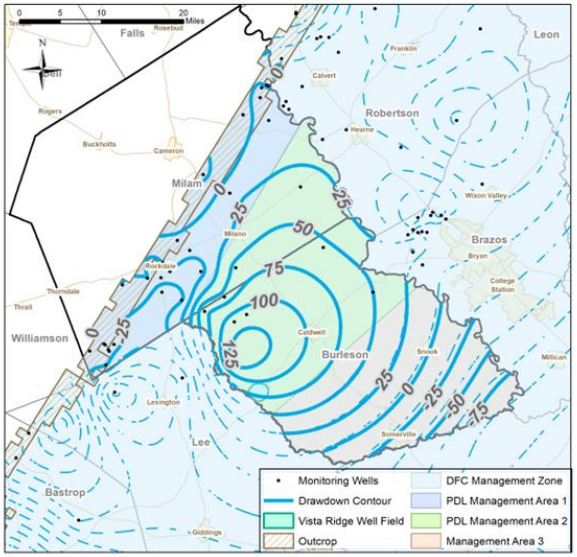
Drawdown 2011 – 2022: Simsboro

- T2R – Software for topography maps
- KWL – Kriging using water levels
- KRS – Kriging using water levels and model results

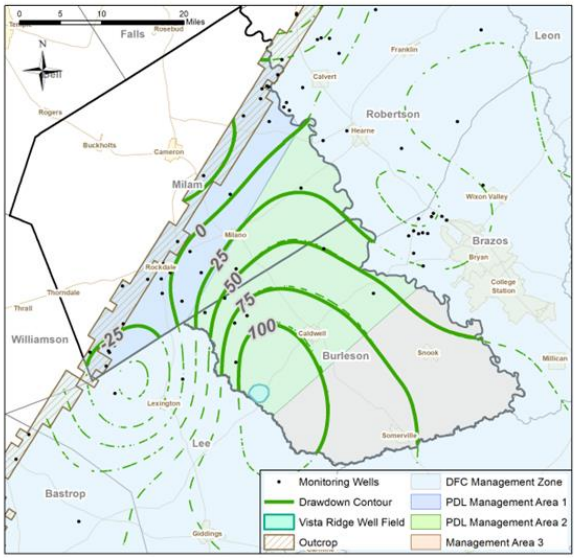




Monitoring Wells used in Simsboro: from 2011 to 2022
T2R Interpolation



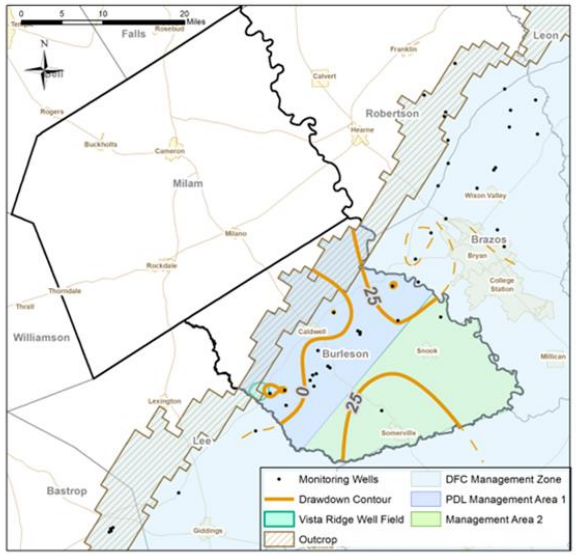
Monitoring Wells used in Simsboro: from 2011 to 2022
KWL Interpolation



Monitoring Wells used in Simsboro: from 2011 to 2022
KRS Interpolation

2011 to 2022 Drawdown

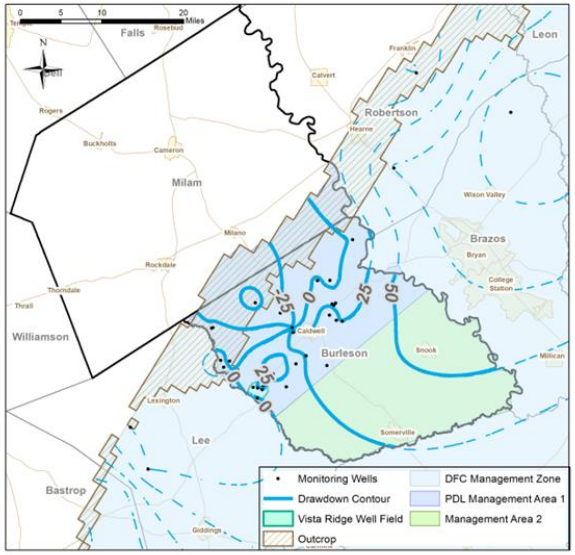
Sparta



Monitoring Wells used in Sparta: from 2011 to 2022
T2R Interpolation

Water level data suggest a decline from 2015 to 2018; gradual rebound from 2018 to 2022

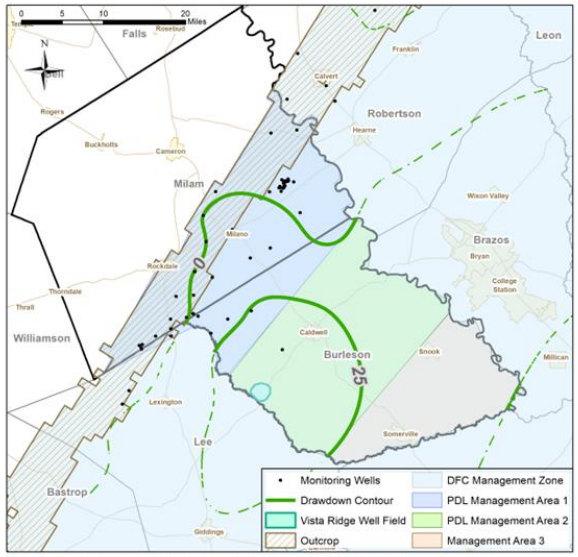
Queen City



Monitoring Wells used in Queen City: from 2011 to 2022
KWL Interpolation

Water level data suggest a decline from 2015 to 2019; gradual rebound from 2019 to 2022

Calvert Bluff

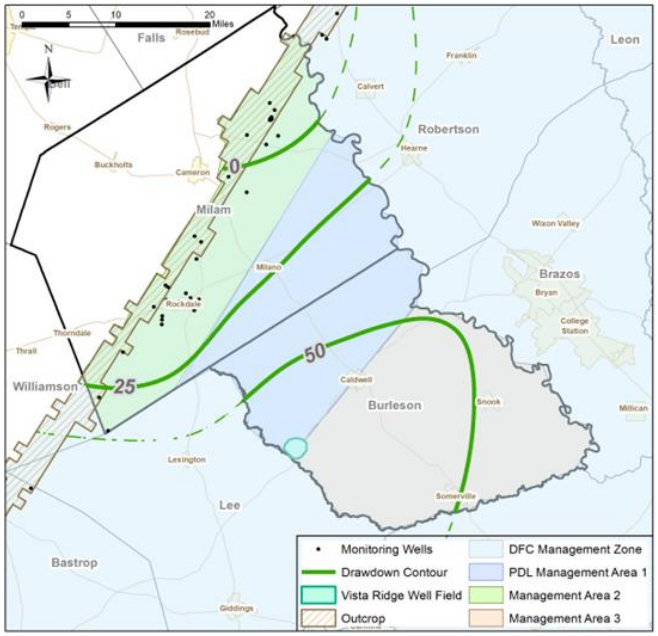


Monitoring Wells used in Calvert Bluff: from 2011 to 2022
KRS Interpolation

Water level data suggest a continual decline since 2011 with increase rate since 2018

2011 to 2022 Drawdown

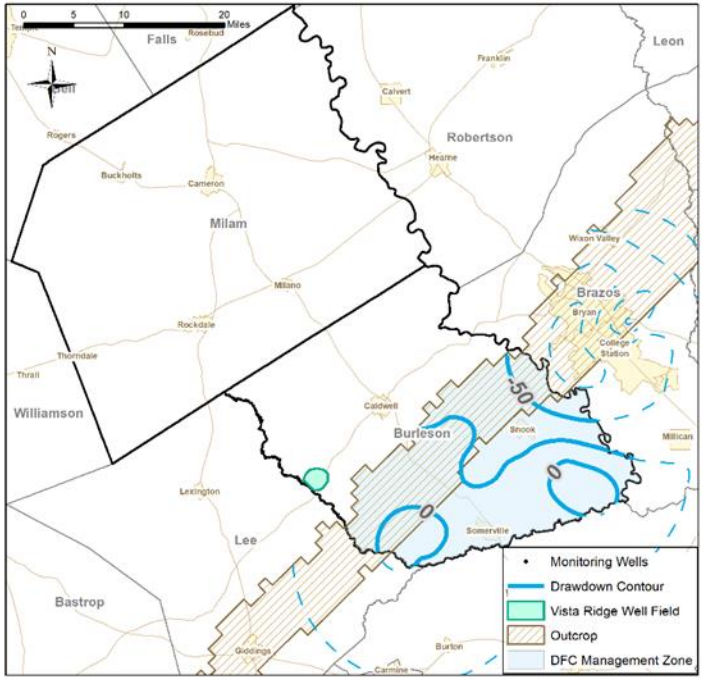
Hooper



Monitoring Wells used in Hooper: from 2011 to 2022
KRS Interpolation

Water level data suggest a gradual rebound 2011 to 2019 and moderate decline from2019 to 2022

Yegua Jackson



Monitoring Wells used in Yegua-Jackson: from 2010 to 2022
KWL Interpolation

Water level data suggest a gradual rebound since 2011

Preliminary GANA Results
(GWAP* Annual Needs Assessment)

*Groundwater Well Assistance Program

Model Simulation & Analysis

- Operational Model
  - August 2021 version
  - Increases Carrizo drawdown relative to GAM
  - Decreases Simsboro drawdown relative to GAM

- Modified GMA S-19 Model Run
  - SLR Production adjusted
  - Adjustments to Robertson pumping (UW Brazos Farm)

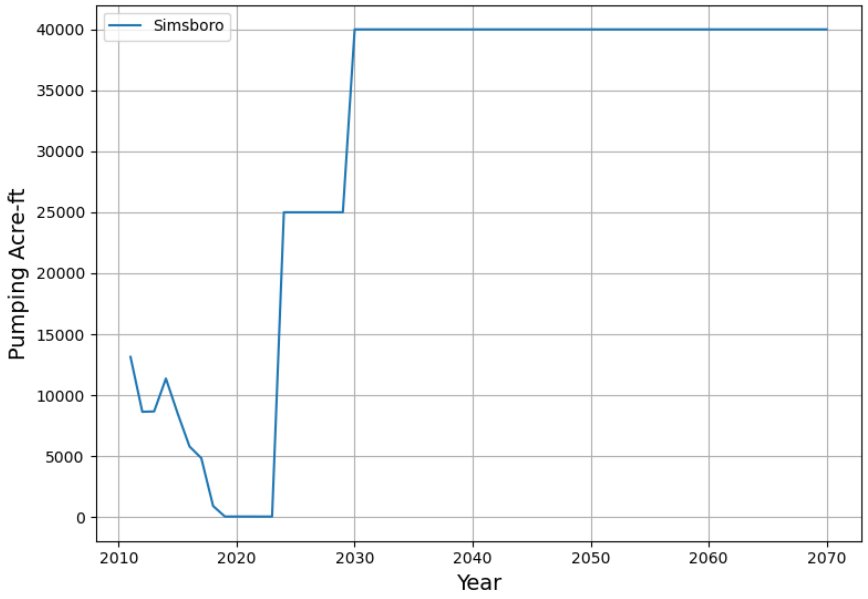
- Preliminary Results
  - Update well database
  - Develop methodology for moderate priority wells

Aquifer	Eligible Wells		
	Without Pump Setting *	With Pump Settings	Total
Carrizo	260	132	392
Calvert Bluff	581	199	780
Simsboro	383	70	453
Hooper	537	176	713

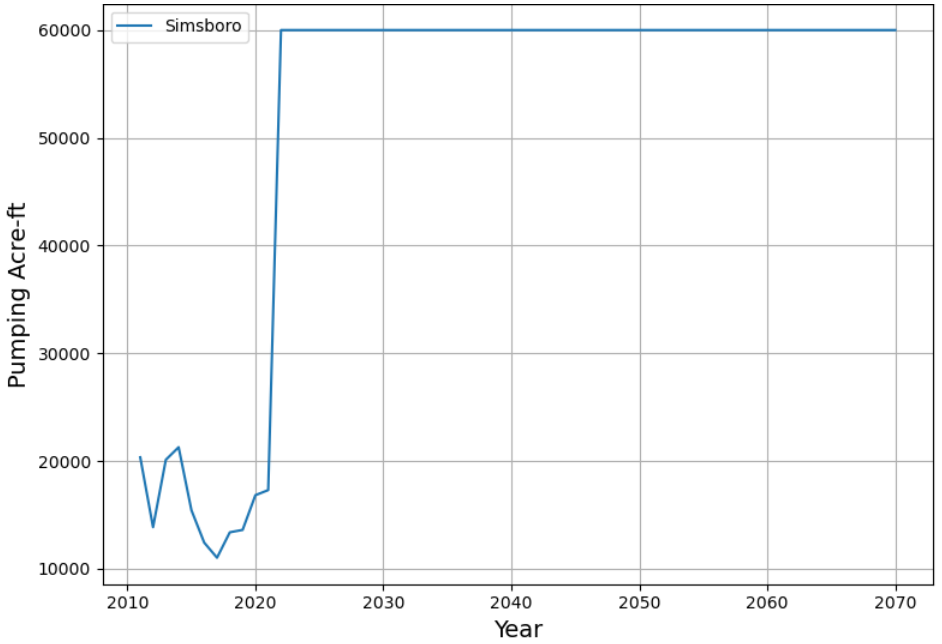
*pump settings are estimated from nearby wells with pump settings

Pumping Adjustments

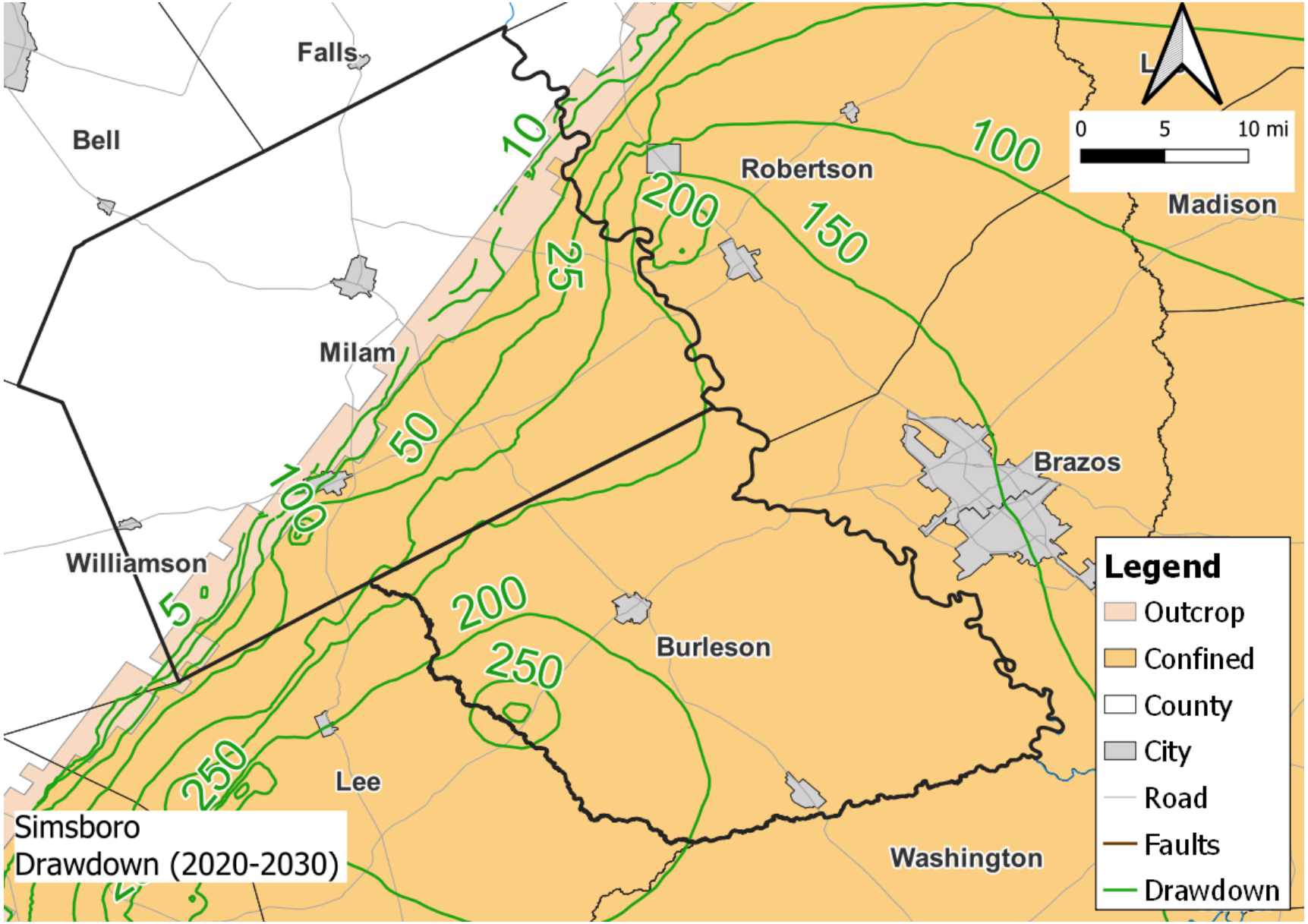
SLR Production



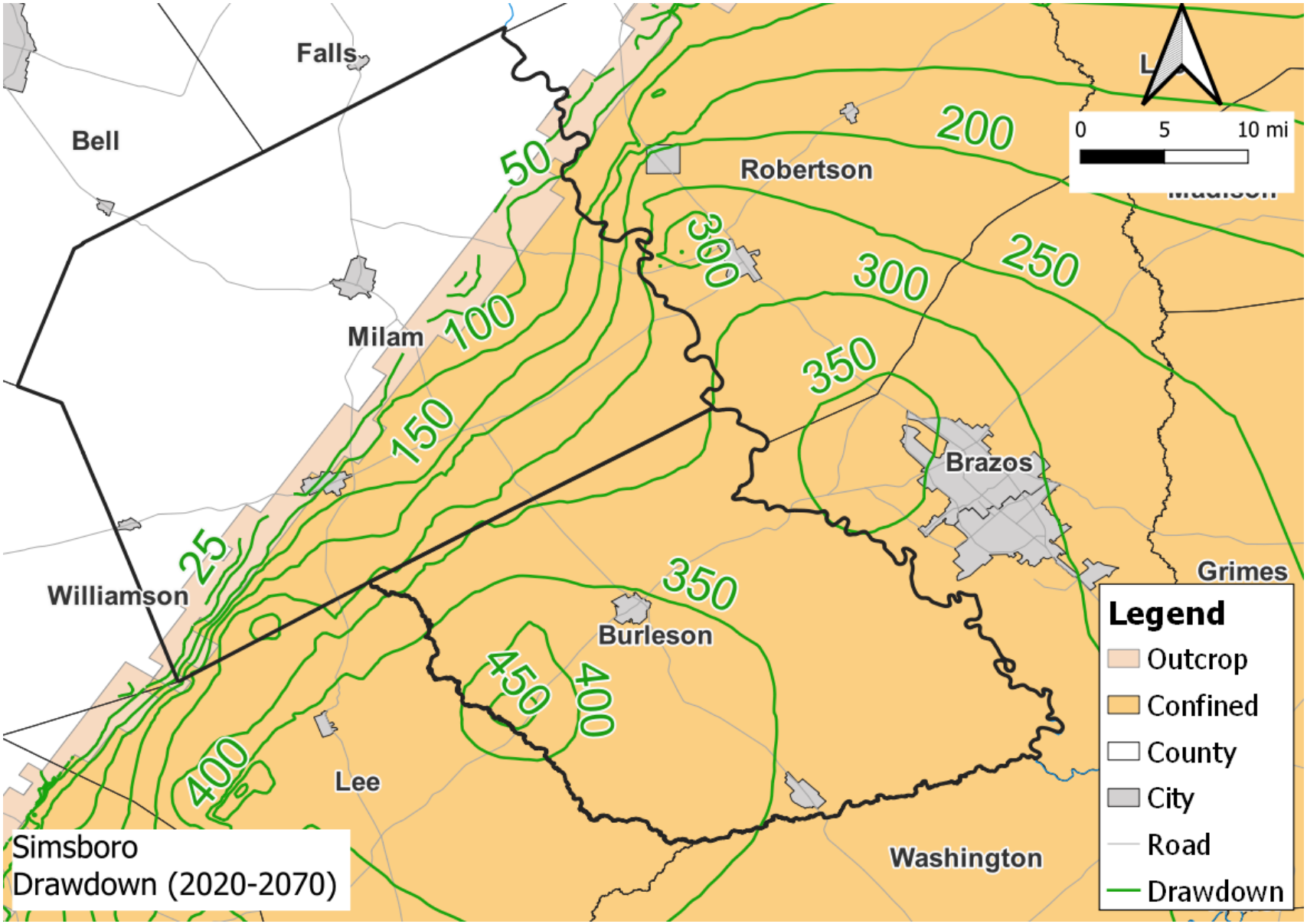
UW Brazos Farm Production



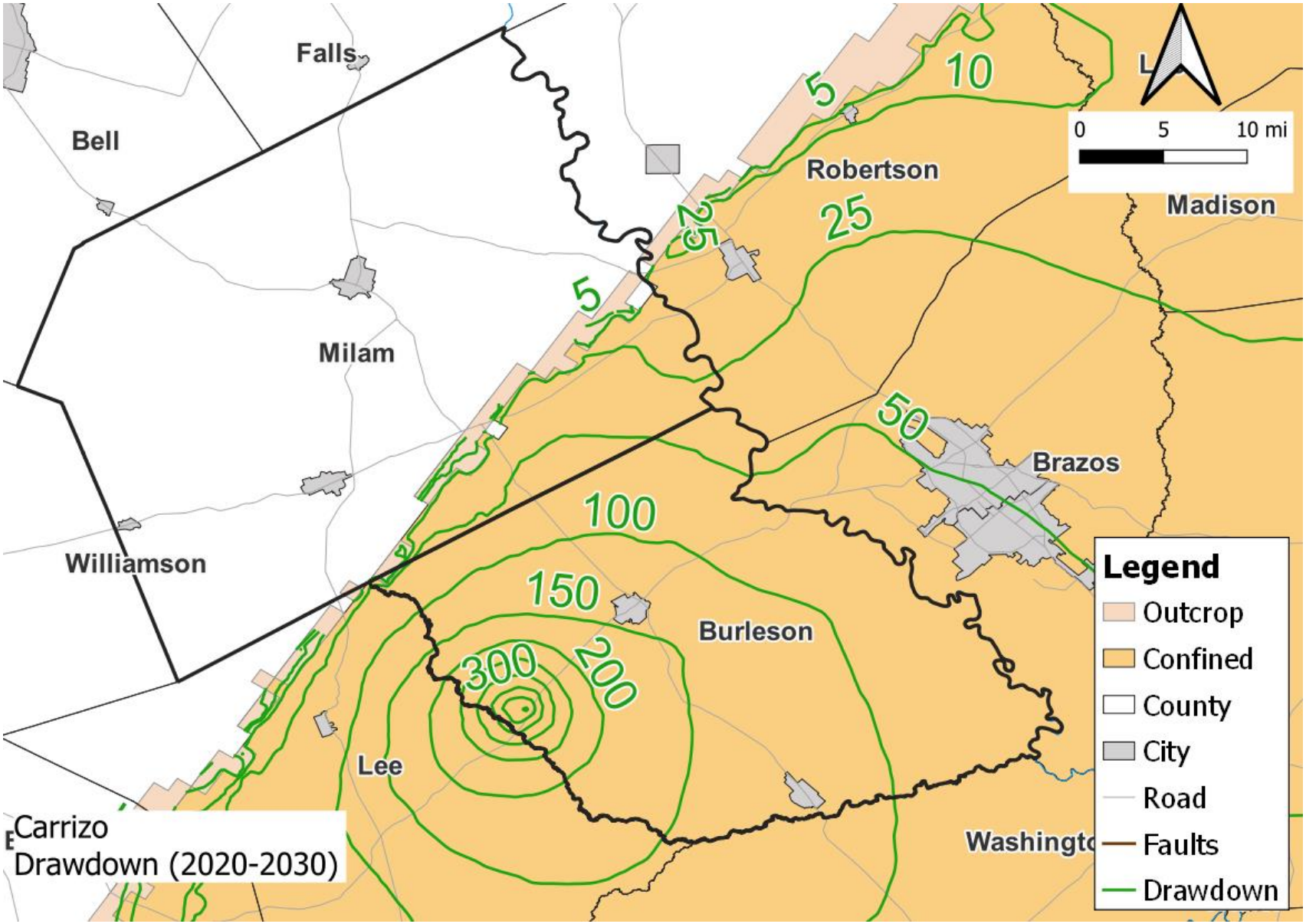
Simulated Water Simsboro Drawdown (2020 – 2030)



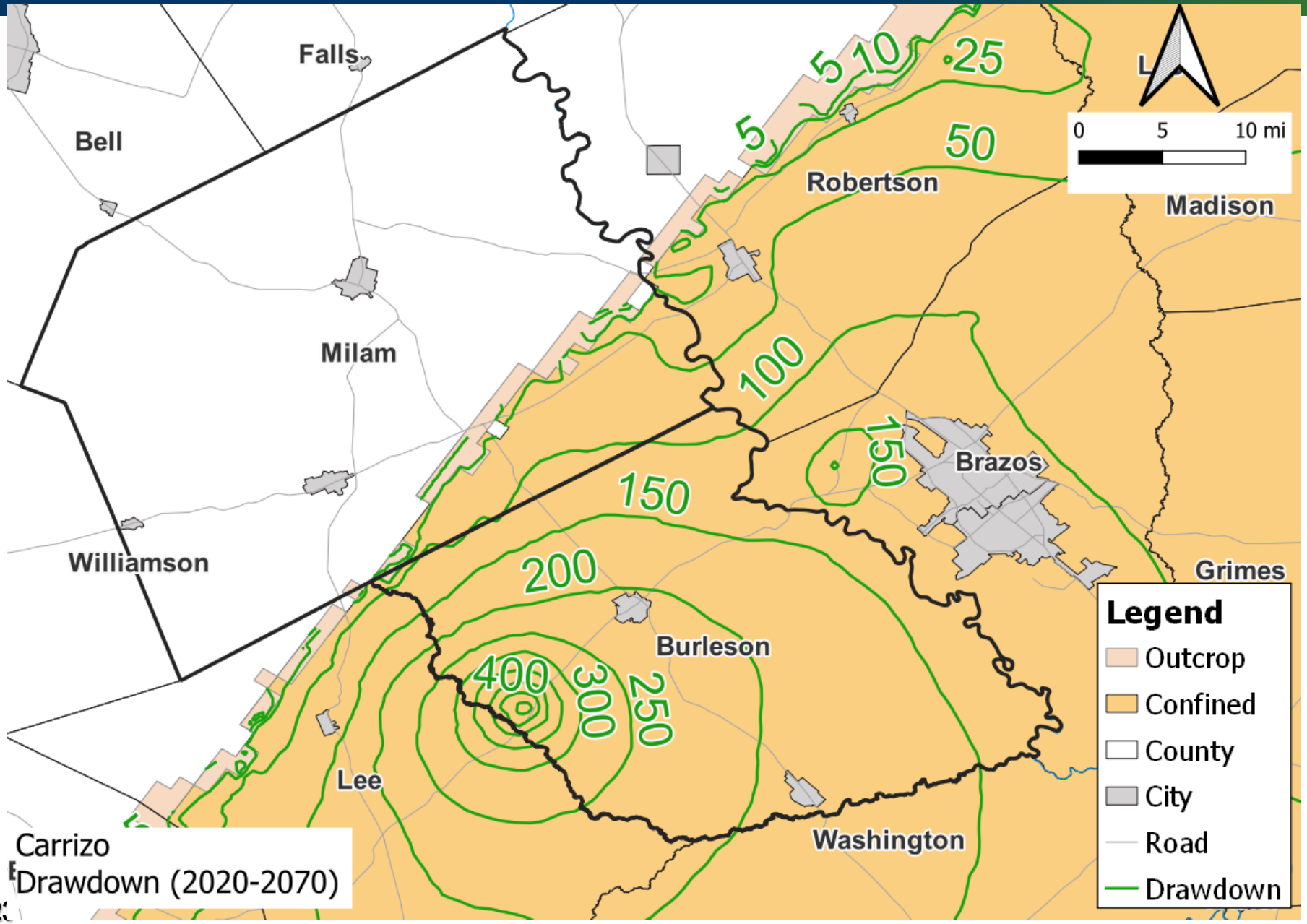
Simulated Water Simsboro Drawdown (2020 – 2070)



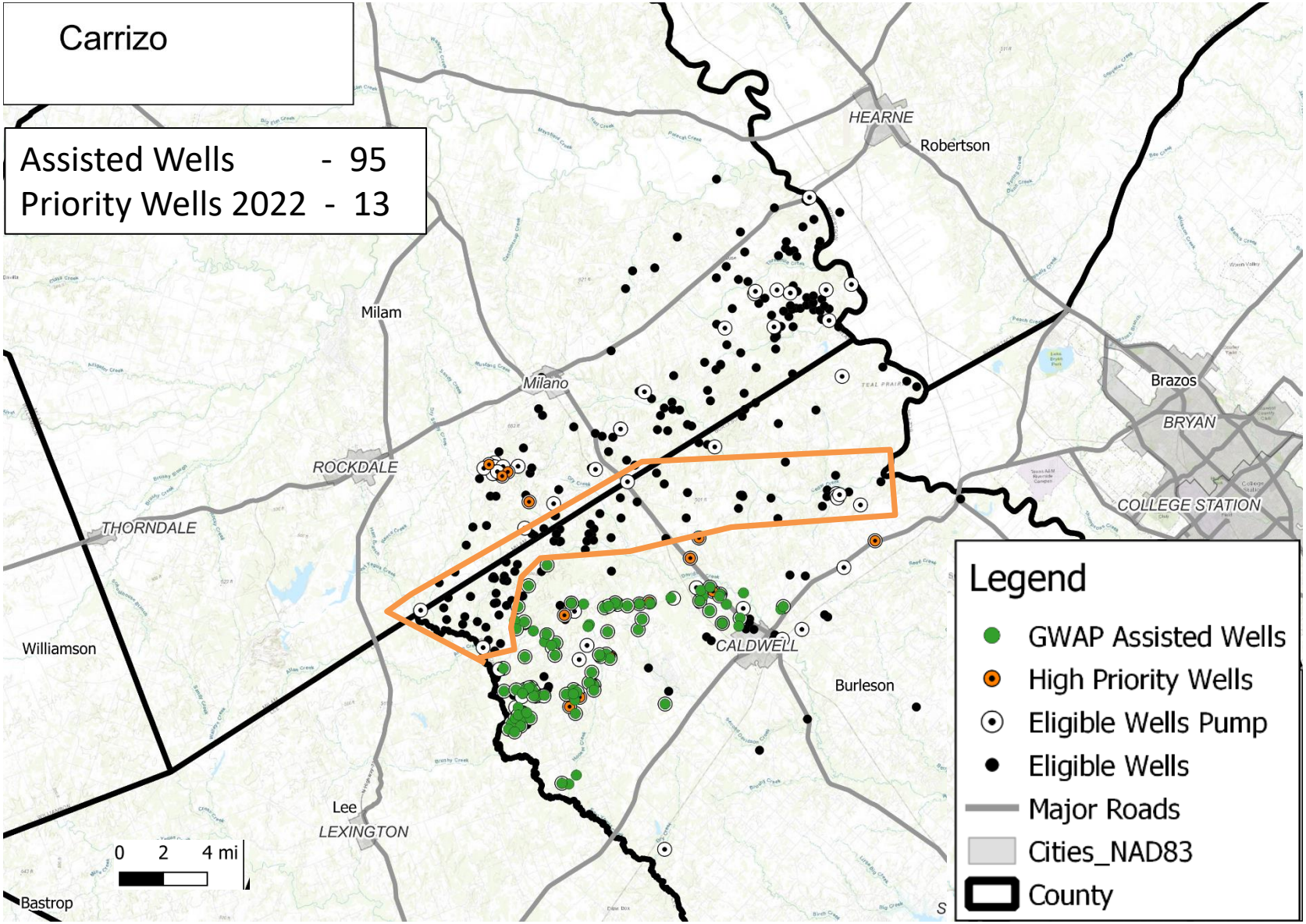
Simulated Water Carrizo Drawdown (2020 – 2030)



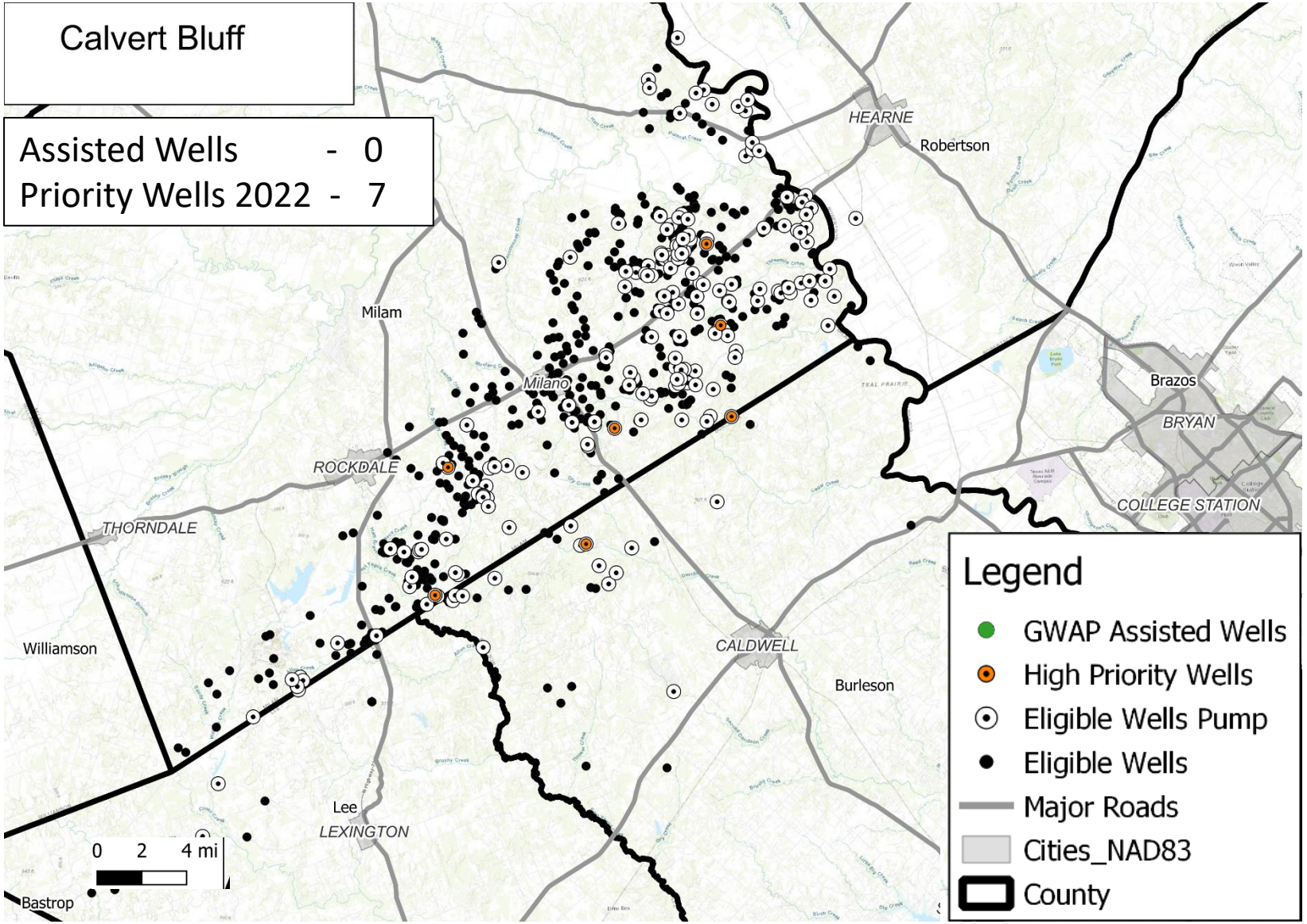
Simulated Water Carrizo Drawdown (2020 – 2070)



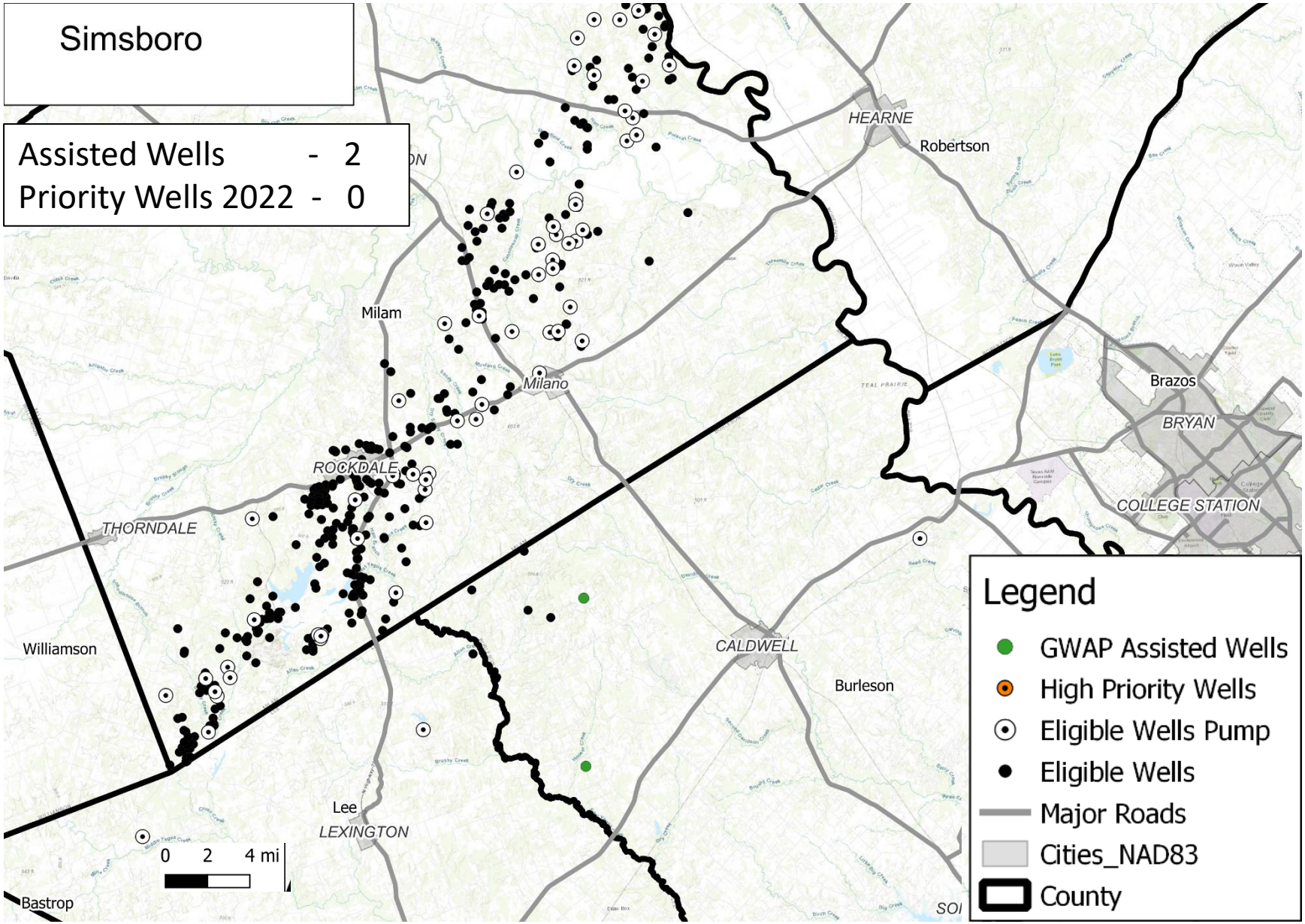
Carrizo


Carrizo
Assisted Wells - 95
Priority Wells 2022 - 13
HEARNE
Robertson
Milam
Milano
Brazos
BRYAN
COLLEGE STATION
ROCKDALE
THORNDALE
Williamson
CALDWELL
Burleson
Lee
LEXINGTON
Bastrop
0 2 4 mi
Legend
GWAP Assisted Wells
High Priority Wells
Eligible Wells Pump
Eligible Wells
Major Roads
Cities_NAD83
County

Calvert Bluff



Simsboro


Simsboro
Assisted Wells - 2
Priority Wells 2022 - 0
HEARNE
Robertson
Milam
Milano
ROCKDALE
THORNDALE
Brazos
BRYAN
COLLEGE STATION
Williamson
CALDWELL
Burleson
Lee
LEXINGTON
Bastrop
0 2 4 mi
Legend
GWAP Assisted Wells
High Priority Wells
Eligible Wells Pump
Eligible Wells
Major Roads
Cities_NAD83
County

Preliminary GANA Results

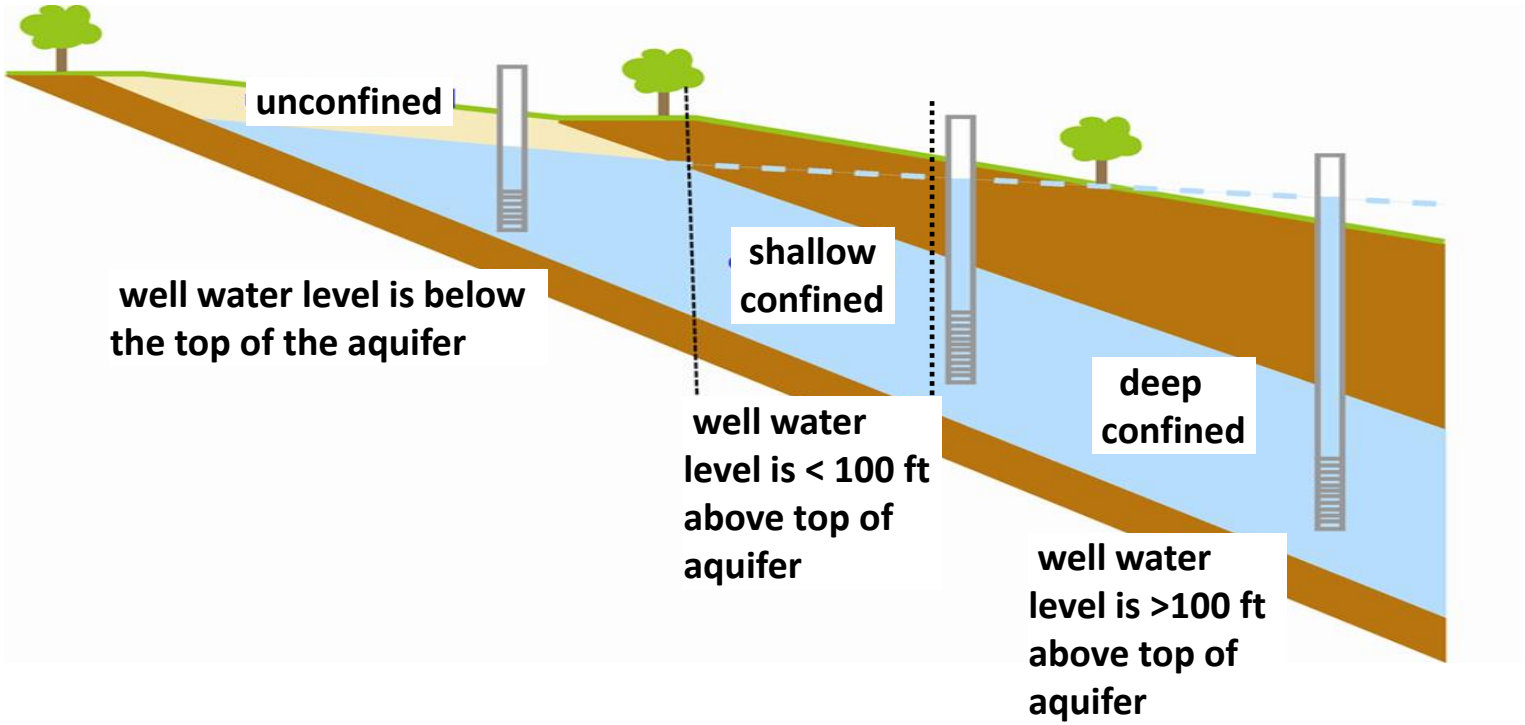
Water Level less than 15 ft above Pump Setting
- High Priority Well (pump info)
- Moderate Priority Well (no pump info)

- GWAP assisted Wells
  - In 2020, 41 wells assisted
  - In 2021, 31 wells assisted
  - In 2022, 30 wells assisted
- 2021 GANA Report
  - 21 High Priority Wells (17 Carrizo, 3 Calvert Bluff, 1 other)
  - 38 Moderate Priority Wells
  - 41 Wells of Concern
- 2022 Preliminary GANA Results
  - 22 wells High Priority Wells (13 Carrizo, 7 Calvert Bluff, 2 other)
  - 2021 Report, 21 wells (17 Carrizo, 3 Calvert Bluff, 1 other)

Driller Guidances

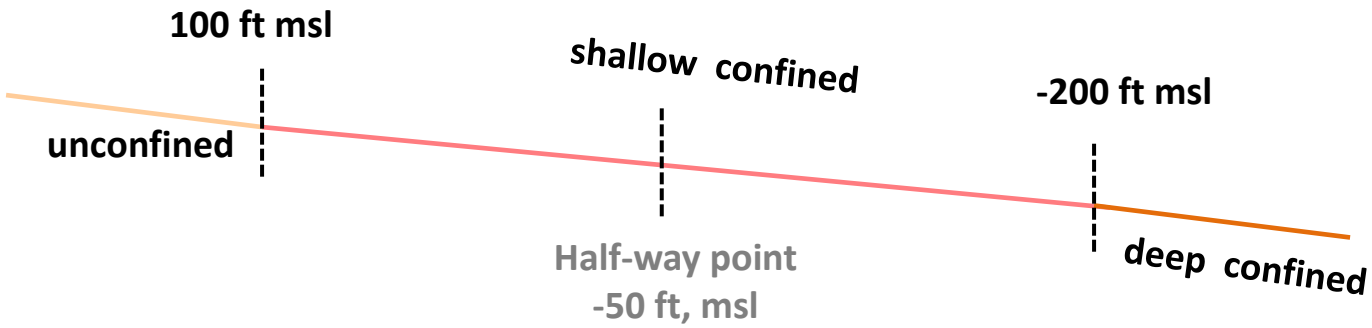
Driller's Guidance

- Purpose
  - Prevent newly drilled wells from having water levels drop below elevation of pump in the next 30 years
  - Currently only applicable for Carrizo-Wilcox Aquifer
- Approach

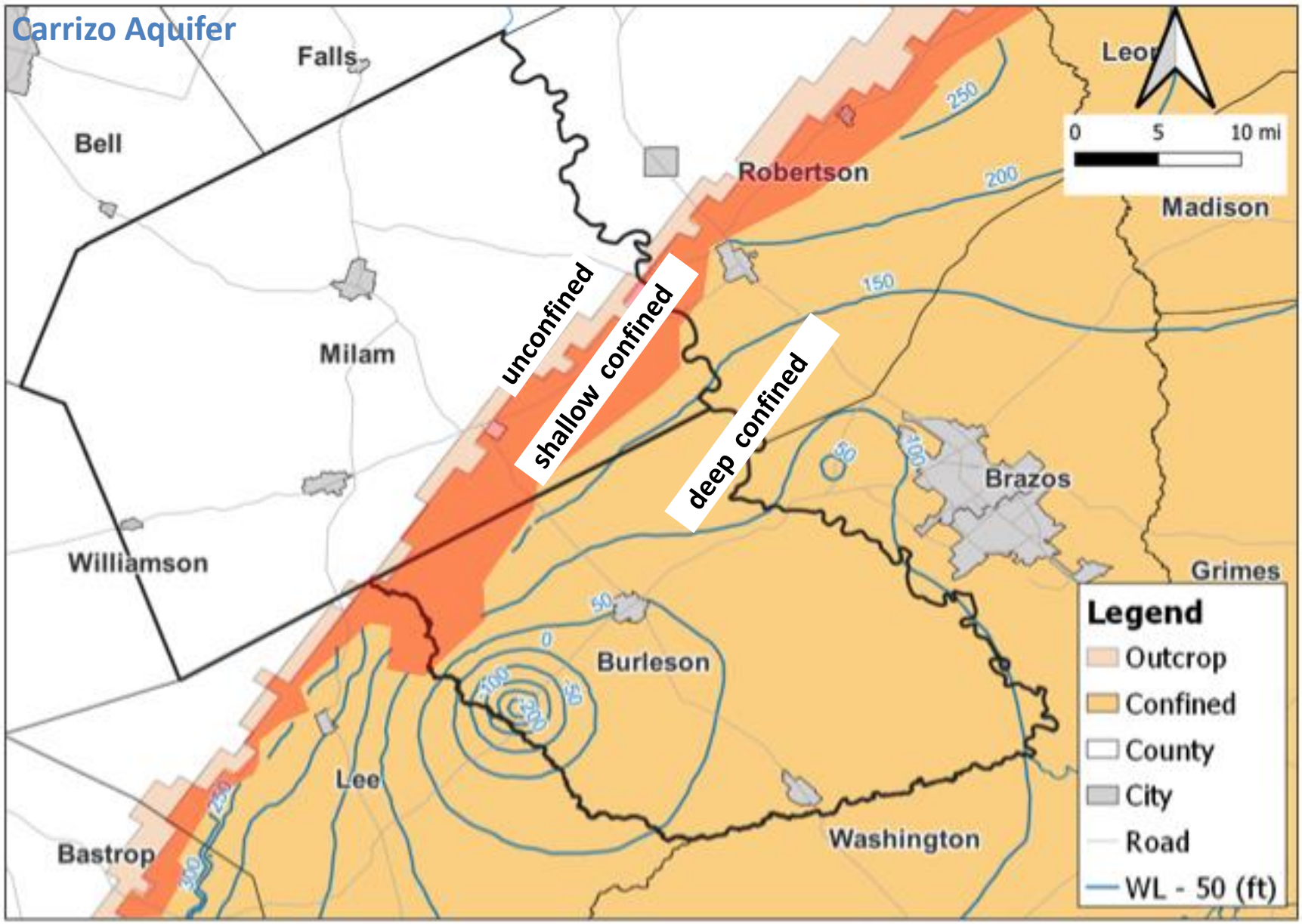


Driller's Guidance for Carrizo-Simsboro Aquifers

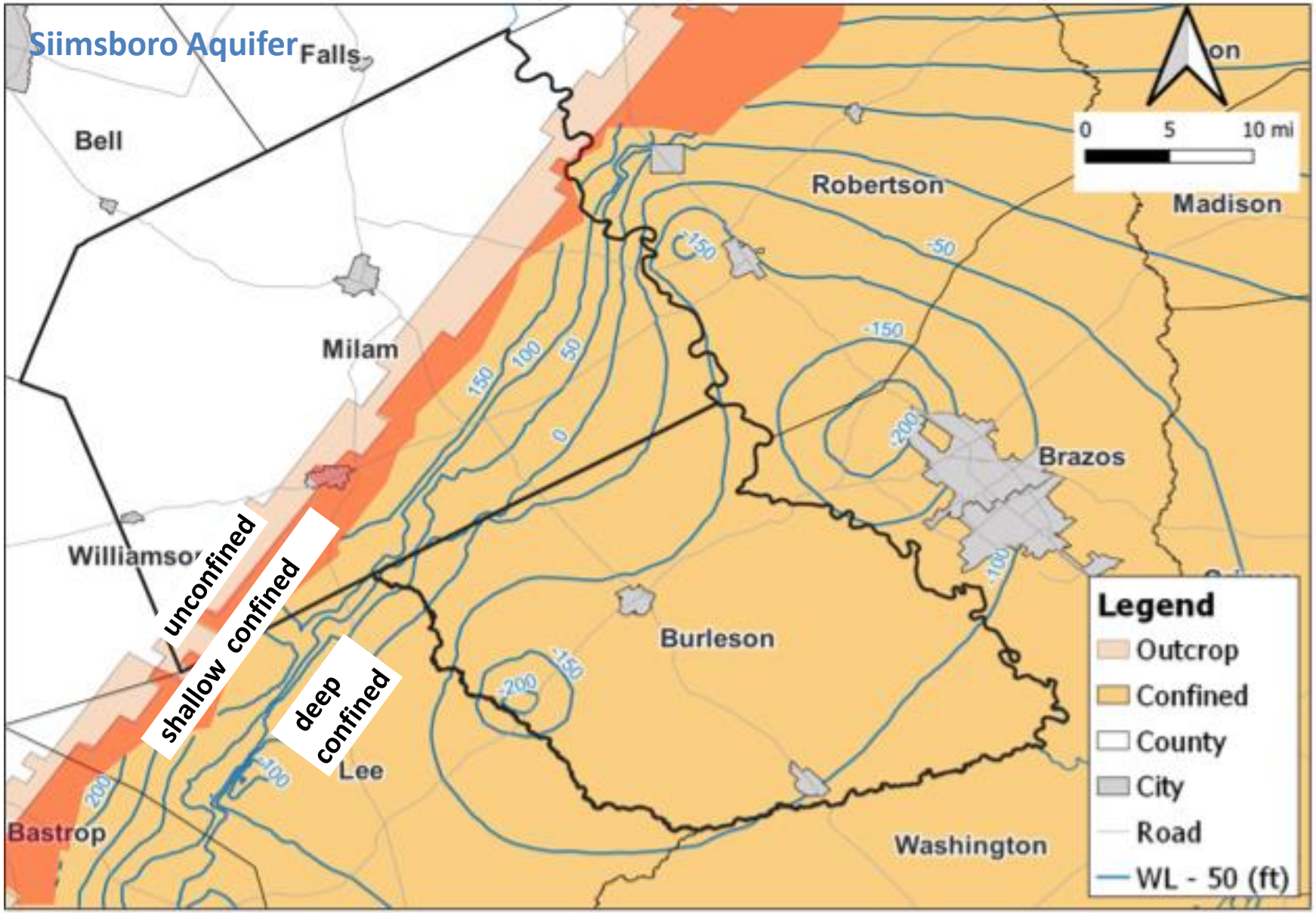
- Deep Zone (Deep Confined Zone)
  - Pump set at least 100 below 2050 water level elevation
  - Estimated 2050 water level
    - Use POSGCD operation model instead of GAM
    - Modify S-19 pumping based on current information on permits
- Outcrop
  - well screen set in lower section of the aquifer & pump set above well screen
- Shallow Confined Zone
  - Wells screen set is based on a weighted average of the Deep Zone elevation and the outcrop elevation



Example Deep Zone: Carrizo



Example Deep Zone: Simsboro



Implementation of the Driller's Guidance

1. Add Section to POSGCD Drilling Application Regarding GWAP
   - Acknowledge eligibility requirements by signature
2. Modify "Certificate to Proceed with Drilling" and "Drilling Permits"
   - Add language to include requirement
   - Append a "GWAP Letter"
3. Modify "Driller's Completion to Permit Application"
   - statement regarding GWAP recommendation were followed

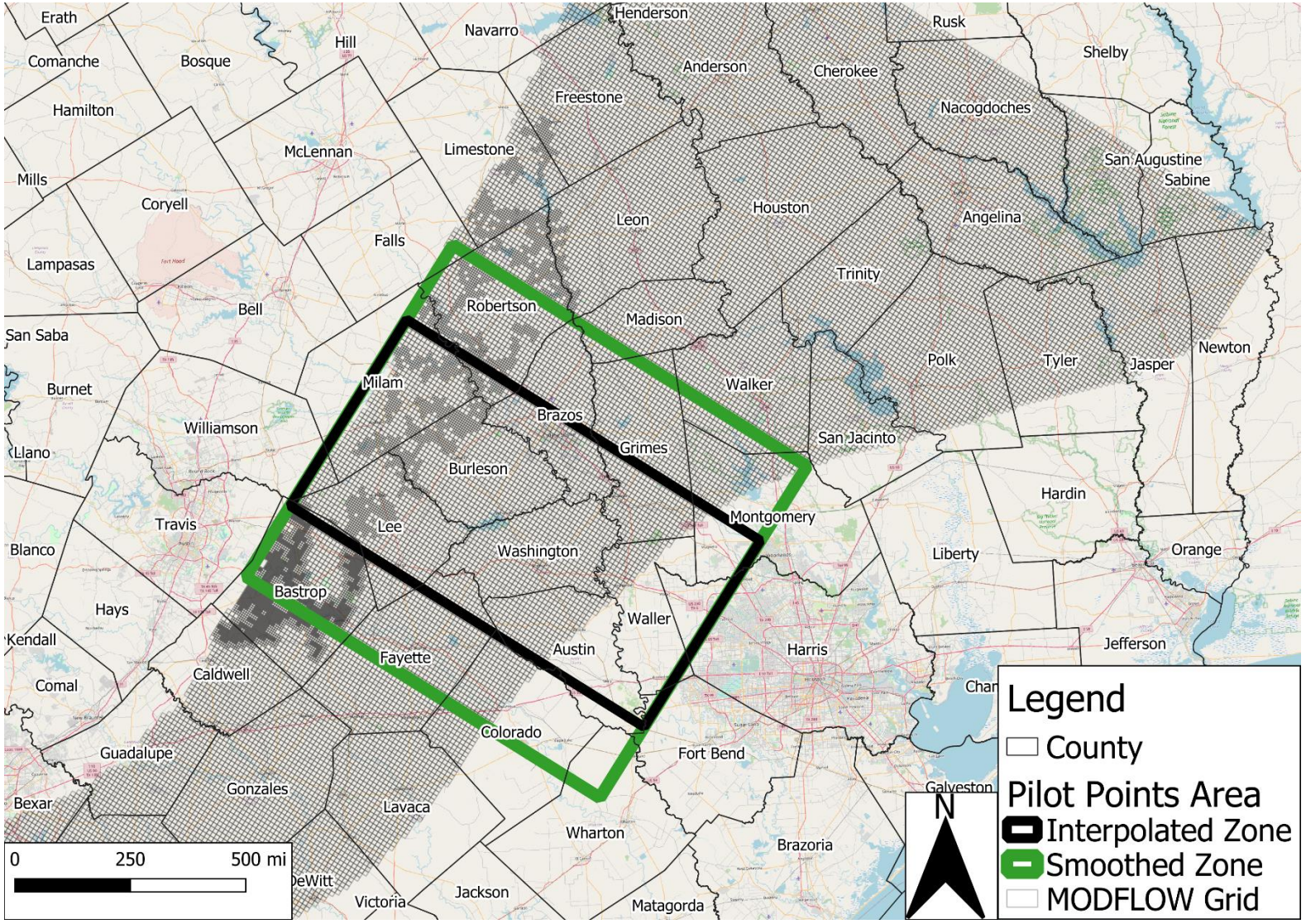
Implementation of the Driller's Guidance (con't)

1. Implementation Approach
   - On-line tool available to drillers and public
   - District performs the analysis
   - Notifications provided by the District

2. Public Awareness
   - Announcements
   - Webpage
   - Seminars for Drillers

Operational Model Update

GAM Recalibration Area for Aquifer Hydraulic Properties

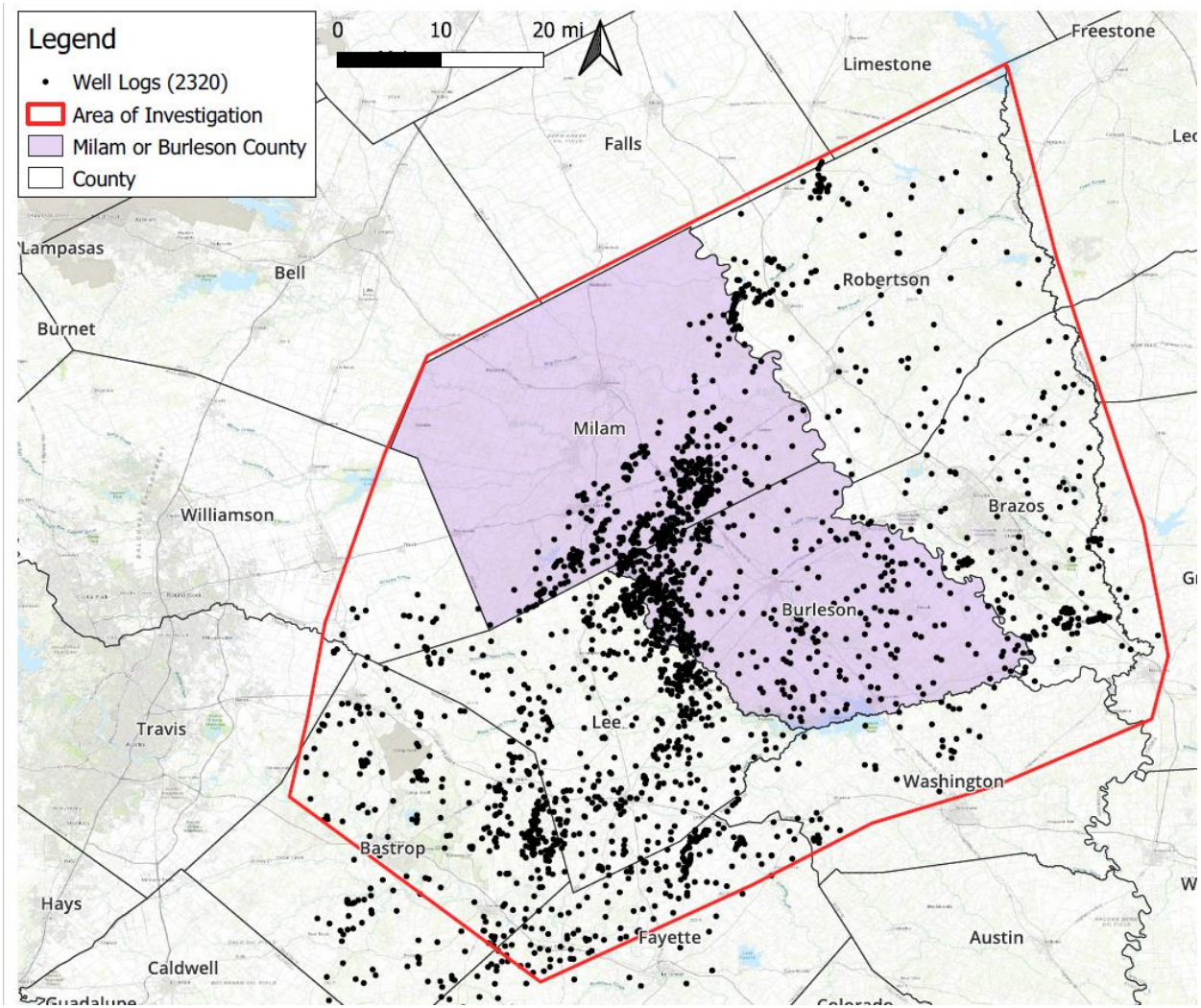


On-going Activities

- Production and Monitoring Wells
  - Well information from BVGCD, METCGD, LPGCD
  - Updating the 2018 GAM Master Well File
  - Next request is historical annual production
- Water Levels from Transducers
  - Weekly Simulation of Vista Ridge Pumping
  - Automating download of hourly data
- Adding of EndLakes
  - Obtaining estimates of lake elevations
  - Evaluating which lakes should be included

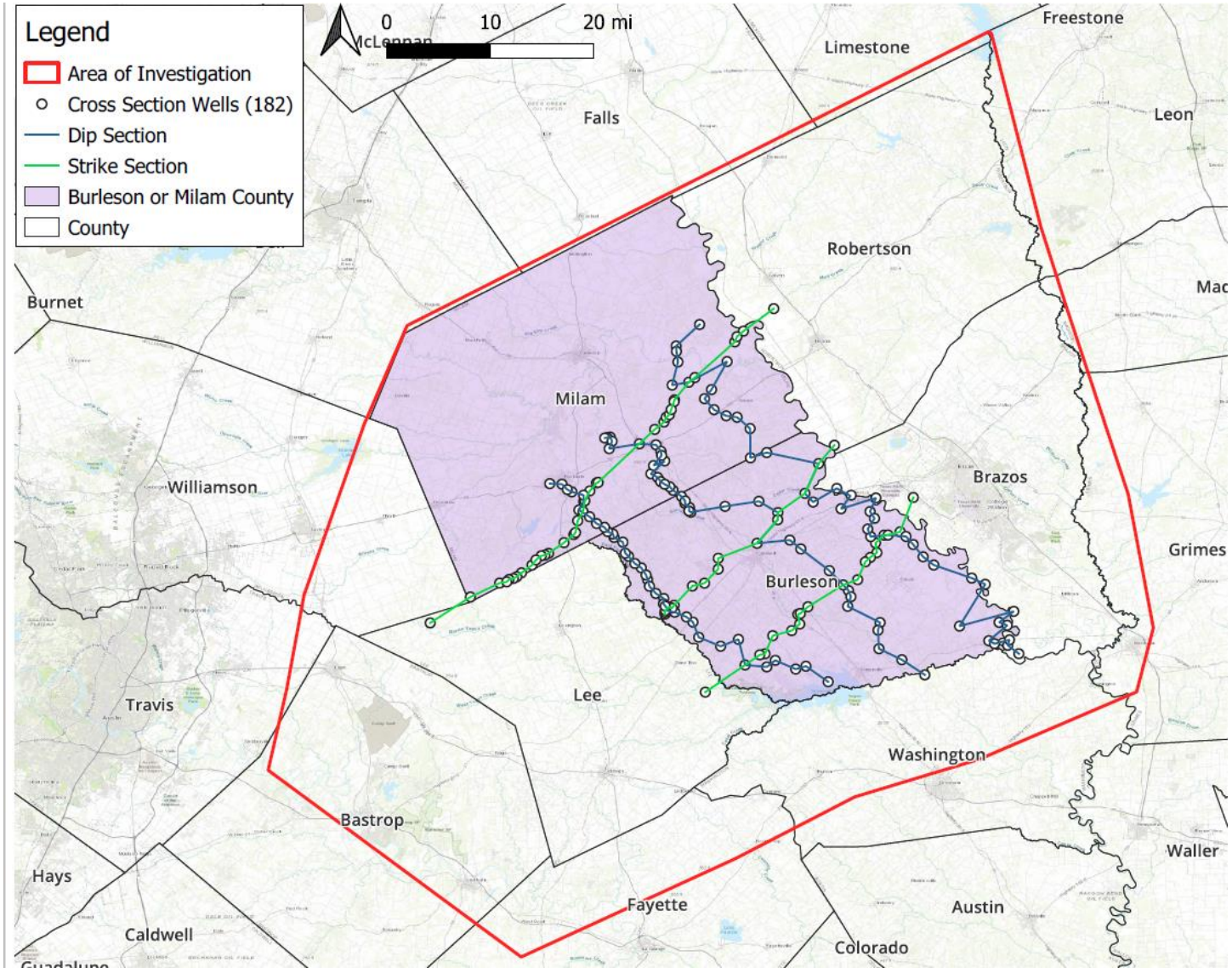
On-going Activities: Revised Geology

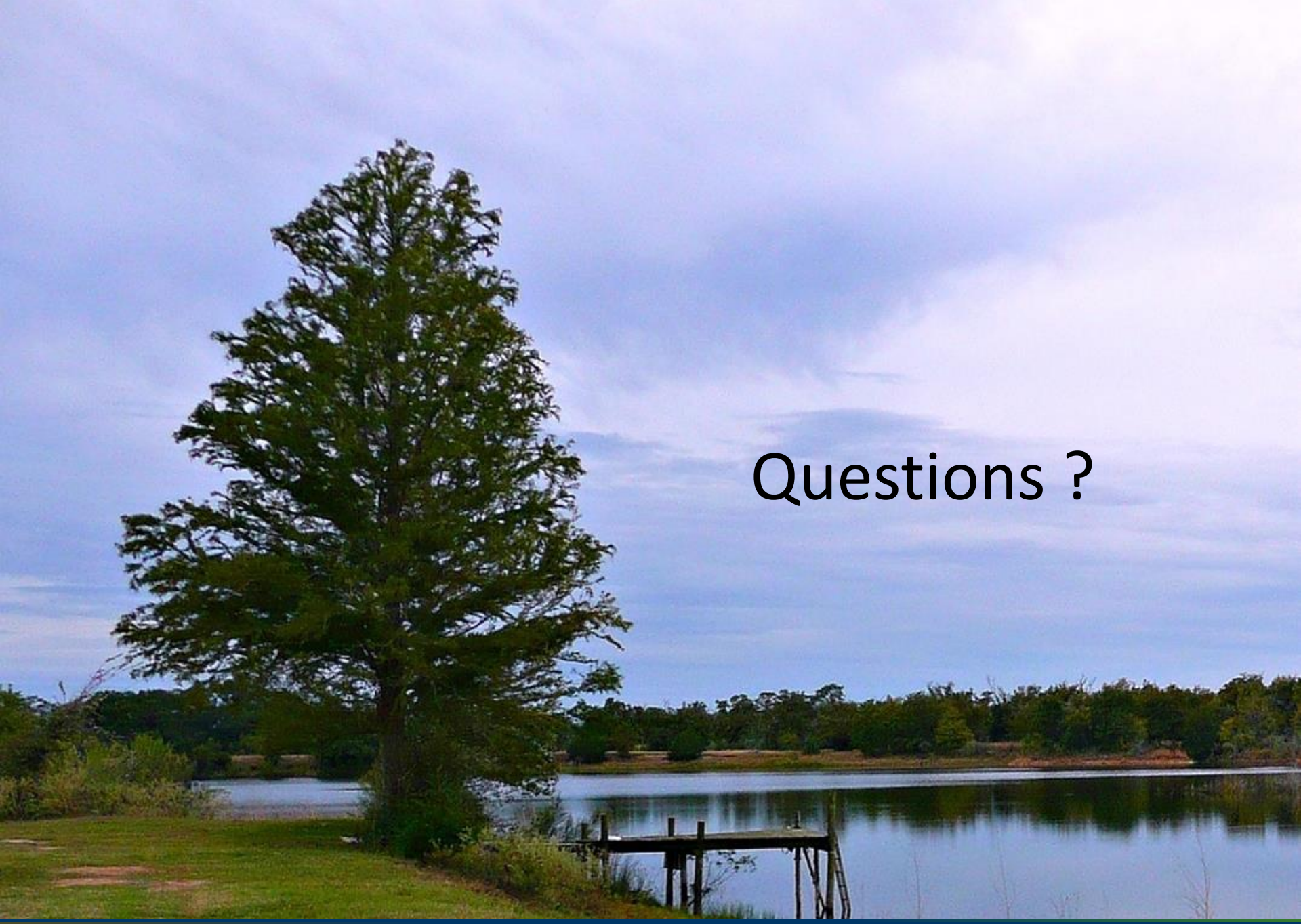
Geology picks for the Carrizo-Wilcox Aquifer will be updated in the Area of Investigation Based on Analysis of Geophysical Logs



On-going Activities: Geology Report

Geology Report will include Six Cross-Sections.




Questions ?